

In the Claims:

1. A machine for conveying a carton including a lid having at least one flap along a path, comprising:
an overhead conveyor including at least one first lug selectively movable to a depending position for engaging and conveying the carton in a first direction along the path;
5 a takeaway conveyor adjacent to the overhead conveyor including at least one second lug selectively movable to an upstanding position for engaging and conveying the carton in a second direction along the path, said second direction being generally perpendicular to the first direction; and
10 means for folding the at least one flap while the carton is conveyed along the path by the overhead conveyor or the takeaway conveyor.
2. The machine according to claim 1, wherein the first lug moves between a retracted position overlying the conveying path and the depending position.
3. The machine according to claim 1, wherein the takeaway conveyor includes a pair of generally parallel conveyor chains, each including at least one second lug.
4. The machine according to claim 3, wherein each second lug is a pop-up lug movable between a retracted position below the conveying path and an upstanding position.
5. The machine according to claim 1, further including a rotatable wheel having at least one projection for at least partially closing the first flap before or during the engagement of the carton by the depending lug of the overhead conveyor.

6. The machine according to claim 1, wherein the means for folding the at least one flap includes a first stationary plow positioned along the overhead conveyor and at least one roller wheel for completing the folding in association with the plow.

7. The machine according to claim 6, wherein the carton includes first, second, and third flaps, and further including means for folding the second and third flaps positioned along the takeaway conveyor.

8. The machine according to claim 7, wherein the means for folding the second and third flaps comprises a stationary plow for associated with each of the second and third flaps and at least one roller wheel for completing the folding of each of the second and third flaps in association with the corresponding plow.

9. The machine according to claim 1, further including means for applying or activating an adhesive for sealing the at least one flap.

10. A machine for conveying a carton and at least partially folding a flap associated with a trailing end of the carton, comprising:

a rotatable wheel having at least one radially extending projection for engaging and at least partially folding the flap; and

5 an overhead conveyor including at least one lug selectively movable to a depending position for engaging the trailing end of the carton once the flap is at least partially folded by the projection and conveying the carton in a conveying direction,

10 whereby the partial folding by the wheel helps to prevent the flap from being damaged by the depending lug.

11. The machine according to claim 10, wherein the overhead conveyor

includes a pair of parallel conveyor chains, each carrying a plurality of lugs independently and selectively movable to the depending position.

12. The machine according to claim 11, wherein the plurality of lugs associated with each chain overlap with each other in the conveying direction.

13. The machine according to claim 10, wherein the rotatable wheel includes a plurality of radially-extending projections.

14. The machine according to claim 10, further including a sensor for sensing the location of the carton and generating a signal used to actuate the wheel to rotate and move the projection into engagement with the flap.

15. The machine according to claim 10, further including a support surface along which the carton is conveyed by the overhead conveyor.

16. The machine according to claim 10, further including a takeaway conveyor for engaging and conveying the carton upon exiting the overhead conveyor.

17. The machine according to claim 16, wherein the takeaway conveyor is generally perpendicular to the overhead conveyor.

18. The machine according to claim 16, wherein the takeaway conveyor includes a pair of parallel conveyor chains, each including a plurality of lugs independently and selectively movable to an upstanding position.

19. The machine according to claim 10, further including an infeed conveyor for feeding randomly received cartons to the overhead conveyor at a substantially constant speed.

20. A conveyor for conveying a carton, comprising:
an endless chain driven in a conveying direction along an endless path having a forward run, a return run, and a first transition from the forward run to the return run, said chain including at least one lug;
5 a guide structure positioned at least partially along the forward run, said guide structure having a first surface and a second surface; and
a pivotable finger elongated in the conveying direction and located at the first transition, said finger having a first, home position for allowing the at least one lug to pass in a retracted position and a second position for selectively guiding
10 at least a portion of the lug into engagement with the second surface,
wherein the second surface of the guide structure is contoured to gradually move the lug to an actuated or operative position for engaging or conveying the carton.
21. The conveyor according to claim 20, wherein the finger is tapered and includes opposed surfaces for engaging the portion of the lug and further including a rotary solenoid for pivoting the finger between the first and second positions.
22. The conveyor according to claim 20, wherein the portion of the lug is a transverse tab having: (1) a generally flat first face for engaging the finger in the second position and the second surface of the guide structure; and (2) an inclined second face for engaging the finger in the first position and the first surface of the
5 guide structure.
23. The conveyor according to claim 20, wherein the engagement with the finger in the second position pivots the lug approximately 10° before engaging the second surface of the guide structure.

24. The conveyor according to claim 23, wherein the engagement with the second surface pivots the lug approximately 50°.

25. The conveyor according to claim 20, wherein the lug includes a slot for receiving a pin associated with the conveyor chain, wherein the slot defines a maximum range of pivoting movement for the lug.

26. The conveyor according to claim 20, wherein the lug is adapted for engaging a leading end of the carton being conveyed.

27. The conveyor according to claim 20, wherein the lug is adapted for engaging a trailing end of the carton being conveyed.

28. A driven conveyor for selectively engaging an object capable of moving in a conveying direction, comprising:

a plurality of lugs, each capable of moving from a normal position to an actuated position in which at least part of the lug extends in a generally vertical direction for engaging the object; and

a diverter for selectively diverting a selected lug in the normal position to the actuated position,

wherein at least a portion of a first lug overlaps with at least a portion of a second, adjacent lug in one of the conveying direction or a direction generally transverse to both the conveying direction and the vertical direction when the first and second lugs are in the normal position.

29. The conveyor according to claim 28, wherein the lugs are structurally identical, and a distance from a corresponding point on each of the first and second lugs in the normal position measured in the conveying direction is about 2.5 inches or less.

30. The conveyor according to claim 28, further including an endless chain carrying and connecting the lugs, each foot of chain as measured in the conveying direction including at least four lugs.

31. The conveyor according to claim 28, wherein the portion of the first lug in the normal position overlaps with the portion of the second lug in the actuated position.

32. The conveyor according to claim 31, wherein the first lug is a leading lug.

33. The conveyor according to claim 28, wherein the first and second lugs are spaced apart a distance no greater than a width of a single lug in the conveying direction when in the actuated position.

34. The conveyor according to claim 28, wherein the part of each lug extending in the generally vertical direction is a pusher having an engagement face adapted for engaging the object being conveyed, wherein the engagement face is generally perpendicular to the conveying direction when the corresponding lug is in the actuated position.

35. The conveyor according to claim 34, wherein the pusher of the first lug in the normal position is the portion overlapping with the portion of the second lug in the conveying direction.

36. The conveyor according to claim 34, wherein the engagement face of the pusher is oriented at an acute angle relative to a generally horizontal plane when the corresponding lug is in the retracted position.

37. The conveyor according to claim 34, wherein the pusher is upstanding relative to the conveyor when the corresponding lug is in the actuated position.

38. The conveyor according to claim 34, wherein the pusher is depending from the conveyor when the corresponding lug is in the actuated position.

39. The conveyor according to claim 28, wherein the movement from the normal position to the actuated position is pivoting such that a point on the lug follows a generally arcuate path.

40. The conveyor according to claim 28, wherein any lug in the actuated position passively returns to the normal position.

41. The conveyor according to claim 28, wherein the diverter includes a tapered finger having opposed sides and further including a rotary solenoid for rotating the finger between a first position and a second position.

42. The conveyor according to claim 28, wherein the diverter further includes a guide structure having a first surface and a second surface, wherein the finger in the first position allows the lugs to pass in the normal position and in the second position selectively engages and guides a portion of the lug into engagement
5 with the second surface.

43. The conveyor according to claim 42, wherein portion of the lug includes: (1) an inclined first face for engaging a first side of the finger in the first position and the first surface of the guide structure; and (2) a generally flat second face for engaging a second side of the finger in the second position and the second
5 surface of the guide structure.

44. The conveyor according to claim 43, wherein the engagement with the second side of the finger pivots the selected lug approximately 10°.

45. The conveyor according to claim 44, wherein the engagement with the second surface of the guide structure pivots the selected lug approximately 50°.

46. The conveyor according to claim 28, wherein each lug includes a slot for receiving a pin associated with a chain interconnecting the lugs, wherein the slot defines a maximum range of pivoting movement for the lug.

47. A driven conveyor for selectively engaging an object capable of moving in a conveying direction, comprising:

5 a plurality of lugs, each capable of moving from a normal position to an actuated position in which at least part of the lug extends in a generally vertical direction for engaging the object; and

a diverter for selectively diverting a selected lug in the normal position to the actuated position,

wherein each lug is spaced apart a distance no greater than a width of a single one of the lugs in the conveying direction when in the actuated position.

48. The conveyor according to claim 47, wherein the lugs are structurally identical, and a distance from a corresponding point on each of the first and second lugs as measured in the conveying direction is about 2.5 inches or less.

49. The conveyor according to claim 47, further including an endless chain carrying and connecting the lugs, with each foot of chain measured in the conveying direction including at least four lugs.

50. The conveyor according to claim 47, wherein a portion of the first lug

overlaps a portion of the second lug in one of the conveying direction or a direction both generally transverse to the conveying direction and the vertical direction, when the first and second lugs are in the normal position.

51. The conveyor according to claim 47, wherein the first lug is a leading lug.

52. The conveyor according to claim 47, wherein a portion of the first lug overlaps with a portion of the second lug in one of the conveying direction or a direction both generally transverse to the conveying direction and the vertical direction, when the second lug is in the actuated position.

53. The conveyor according to claim 47, wherein the part of each lug for engaging the object is a pusher oriented generally perpendicular to the conveying direction when the selected lug is in the actuated position.

54. The conveyor according to claim 53, wherein the pusher is upstanding relative to the conveyor when the corresponding lug is in the actuated position.

55. The conveyor according to claim 53, wherein the pusher is depending from the conveyor when the corresponding lug is in the actuated position.

56. The conveyor according to claim 53, wherein an engagement face of the pusher is oriented at an acute angle relative to a horizontal plane when the corresponding lug is in the retracted position.

57. The conveyor according to claim 47, wherein the movement from the retracted position to the actuated position is pivoting such that a point on the lug follows a generally arcuate path.

58. The conveyor according to claim 47, wherein any lugs in the actuated position passively return to the retracted position.

59. The conveyor according to claim 47, wherein the diverter includes a tapered finger having opposed sides and further including a rotary solenoid for rotating the finger between a first position and a second position.

60. The conveyor according to claim 59, wherein the diverter further includes a guide structure having a first surface and a second surface, wherein the finger in the first position allows the lugs to pass in the normal position and in the second position selectively engages and guides a portion of the lug into engagement
5 with the second surface.

61. The conveyor according to claim 60, wherein the portion of the lug includes: (1) an inclined first face for engaging a first side of the finger in the first position and the first surface of the guide structure; and (2) a generally flat second face for engaging a second side of the finger in the second position and the second
5 surface of the guide structure.

62. The conveyor according to claim 61, wherein the engagement with the second side of the finger pivots the selected lug approximately 10°.

63. The conveyor according to claim 62, wherein the engagement with the second surface of the guide structure pivots the selected lug through a range of motion of about 50°.

64. The conveyor according to claim 47, wherein each lug includes a slot for receiving a pin associated with a chain interconnecting the lugs, wherein the slot defines a maximum range of movement for the lug.

65. A driven conveyor for selectively engaging an object capable of moving in a conveying direction along a conveying path, comprising:

a plurality of lugs capable of moving from a normal to an actuated position such that a part of the lug extends vertically into the conveying path for engaging the object; and

a diverter elongated in the conveying direction and capable of moving from a first position to a second position for engaging and initiating movement of a selected lug to the actuated position;

an actuator for selectively moving the diverter toward the second position; and

a guide structure for maintaining the selected lug in the actuated position for engaging the object;

wherein at least a portion of a first lug overlaps with at least a portion of the second lug in one of the conveying direction or a direction generally transverse to both the conveying direction and the vertical direction, when the first and second lugs are in a normal position.

66. The conveyor according to claim 65, wherein the actuator is a rotary solenoid and the diverter is a tapered finger.

67. The conveyor according to claim 65, wherein the guide structure is specially contoured for gradually moving the selected lug to the actuated position along a transition to a forward run.

68. A system for sequentially receiving and conveying randomly spaced cartons moving along a conveying path, comprising:

a conveyor including at least one chain driven in an endless path with a forward run extending at least partially along the conveying path, said chain including a plurality of closely spaced first lugs adapted for selectively moving into

the conveying path in an actuated condition to engage a next-in-line carton;

a diverter positioned adjacent to the chain, said diverter having a first, home position for allowing the lugs to pass and a second position for guiding a selected lug to the actuated condition,

10 a sensor positioned adjacent the conveyor for sensing the next-in-line carton and generating a corresponding output signal; and

a controller for using the output signal to actuate the diverter to guide the selected lug to the actuated position, ready for engaging the next-in-line carton immediately upon entering the conveying path adjacent the forward run of the
15 conveyor,

whereby efficient conveyance of the cartons is achieved without the need for matching the driving of the endless chain with the receiving of the cartons by the conveyor.

69. The system according to claim 68, wherein the diverter comprises a tapered finger having opposed surfaces for engaging a portion of the selected lug and further including a motive device associated with the controller for pivoting the finger between the first and second positions.

70. The system according to claim 69, wherein the chain includes a return run and a first transition from the forward run to the return run, said finger being elongated in the conveying direction and located along the first transition.

71. The system according to claim 70, further including a guide structure positioned at least partially along the forward run, said guide structure having a first surface and a second surface, said second surface being contoured to gradually move the lug to the actuated condition for engaging the next-in-line carton.

72. The system according to claim 68, wherein the controller includes a

dimension of the next-in-line carton in a conveying direction, whereby a time interval until the next-in-line carton reaches a position for engagement by the selected lug is determined by the controller and used to determine a selected instant in time for
5 actuating the selected lug.

73. The system according to claim 68, wherein at least a portion of a first lug in said plurality of lugs overlaps with at least a portion of a second, adjacent lug in one of the conveying direction or a direction generally transverse to both the conveying direction and the vertical direction when the first and second lugs are in
5 a non-actuated position.

74. The system according to claim 68, wherein the conveyor is a first conveyor including first and second spaced chains, said first chain including the plurality of closely spaced first lugs and said second chain including a plurality of closely spaced second lugs capable of moving to an actuated condition for engaging
5 the next-in-line carton; and

the diverter is a first diverter for guiding the selected first lug to the actuated condition for engaging the next-in-line carton; and further including a second diverter for simultaneously guiding a selected second lug of the second chain to the actuated condition for engaging the next-in-line carton.

75. The system according to claim 74, further including a takeaway conveyor having third and fourth spaced chains, each including at least one lug for engaging and conveying the next-in-line carton exiting the first conveyor.

76. The system according to claim 75, wherein the takeaway conveyor is oriented such that the third and fourth chains of travel in a second direction at a right angle relative to the first and second chains of the first conveyor.

77. The system according to claim 75, wherein each lug on the third and fourth chains is a pop-up lug movable between a retracted position out of the conveying path and an upstanding position in the conveying path.

78. The system according to claim 68, wherein the next-in-line carton includes at least one flap and further including means for folding the at least one flap while the carton is conveyed along the conveying path by the selected lug.

79. The system according to claim 78, wherein the means for folding the at least one flap includes a first stationary plow positioned along the conveyor and at least one roller wheel for completing the folding in association with the plow.

80. The system according to claim 68, wherein the carton includes first, second, and third flaps, and further including means for folding the second and third flaps positioned along a takeaway conveyor downstream from the conveyor.

81. The system according to claim 80, wherein the means for folding the second and third flaps comprises a stationary plow associated with each of the second and third flaps and at least one roller wheel for completing the folding of each of the second and third flaps in association with the corresponding plow.

82. The system according to claim 81, further including means for applying or activating an adhesive for sealing the at least one flap.

83. A method of completing a partially formed carton including a lid having a first flap along a trailing end thereof, comprising:

engaging and at least partially folding the first flap; and

conveying the carton with a lug depending from an overhead conveyor

5 and in engagement with the at least partially folded first flap.

84. The method according to claim 83, wherein the engaging step comprises contacting the first flap with a projection extending radially from a rotatably mounted wheel.

85. The method according to claim 83, wherein the conveying step includes further folding of the at least partially folded first flap using the depending lug.

86. The method according to claim 83, wherein the carton includes a second flap and the method includes the steps of folding and sealing the second flap while the carton is being conveyed by the depending lug.

87. The method according to claim 86, wherein the carton includes a third flap and the method includes the step of sealing the first and third flaps after the depending lug is no longer in contact with the carton and while conveying the carton in a second direction generally perpendicular to a first direction in which the carton
5 was conveyed by the depending lug.

88. The method according to claim 83, wherein the engaging and partial folding steps comprise engaging the flap with the depending lug.

89. A method of completing a partially formed carton including a lid having a first, second, and third flaps, comprising:
conveying the carton in a first direction with the first flap at least partially folded while the second flap is sealed; and
5 conveying the carton in a second direction generally perpendicular to the first direction while the first and third flaps are sealed.

90. The method according to claim 89, wherein the step of conveying the

carton in the first direction comprises contacting the at least partially folded first flap with a lug depending from an overhead conveyor.

91. The method according to claim 90, wherein the step of contacting the first flap with the depending lug is completed after the first flap is partially folded by a rotatable wheel having a radially extending projection.

92. The method according to claim 91, wherein the step of conveying the carton in the second direction comprises contacting the carton with first and second upstanding lugs carried by each of first and second generally parallel, spaced endless chains.

93. A method for conveying cartons along a conveying path, comprising:
randomly feeding cartons to a conveyor including a first chain having
a plurality of closely spaced first lugs;
driving the chain in an endless path including a forward run adjacent
5 the conveying path without regard to the position of a next-in-line carton; and
actuating a selected first lug to engage the next-in-line carton upon
entering the conveying path adjacent the forward run.

94. The method according to claim 93, wherein the conveyor includes a second chain having a plurality of closely spaced second lugs, and the method further includes the step of actuating a selected second lug simultaneous with the actuation of the selected first lug.

95. The method according to claim 93, wherein the step of feeding cartons comprises delivering the next-in-line carton at a substantially constant speed to the conveyor, and the method further includes sensing a leading edge of the next-in-line carton and using a dimension of the next-in-line carton in the conveying direction and

- 5 the substantially constant speed to determine when a trailing edge of the next-in-line carton is in a position along the conveying path adjacent the forward run for engagement by the selected lug.